“ *Anſ.* There was not any ſound heard: it was
“ ſuppoſed to be at too great a diſtance.”

Theſe are all the accounts which I received, at different times, upon this ſubject. In another paper I ſhall offer to the Society ſome remarks, that have occurred to me, upon a careful review of the whole materials.

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## XXVII. *Some Remarks upon the ſeveral Accounts of the fiery Meteor (which appeared on* Sunday *the* 26*th of* November, 1758), *and upon other ſuch Bodies; by* John Pringle, *M. D. F. R. S.*

Read Dec. 20, 1759.

IN my laſt paper, I laid before the Society all the accounts I had received of the meteor, of the 26th of November, 1758; which I could not reduce into a narrower compaſs, without the hazard of omitting ſuch obſervations, as might be judged neceſſary for aſcertaining ſome of the principal circumſtances; or without paſſing over thoſe facts, which, however immaterial they may appear at preſent, might afterwards afford ſome light in explaining the nature of theſe *phænomena*. I have even inſerted ſome particulars contradictory to others, that I imagined more likely to be true, as I myſelf might be deceived, and as, by preſerving the ſeveral relations intire, I thereby did moſt juſtice to the obſervers. The deception of the ſenſes, upon the appearance of unuſual objects, the ſhort continuance of the meteors, and the

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the ſurprize occaſioned by them, at a late hour, among people unaccuſtomed to think on theſe ſubjects, will ſufficiently account, not only for the variety, but the contradictions, in the ſeveral obſervations.

I come next to the reſult of all the relations, with regard to the true path, the velocity, figure, magnitude, and other circumſtances relating to this body; which having deduced in the beſt manner I could from the preceding materials, I ſhall now ſubmit to the judgment of the Society. But as my laſt paper on this ſubject was of ſo great a length, I ſhall not farther inſiſt on it now, than barely to mention the concluſions I have made, without loſing time in recapitulating the ſeveral ſteps that led me to them *.

Firſt then, as to the path. This meteor ſeems to have been vertical at Cambridge, or nearly ſo, and to have taken fire about the zenith of that place; or at leaſt to have appeared firſt there in a ſtate of ignition. From thence it proceeded directly, almoſt N. W. by N. over ſeveral counties in England, over the Solway frith (which it croſſed between Carliſle and the town of Dumfries); and in Scotland over the ſhires of Dumfries and Lanerk: but ſoon after its becoming vertical to the laſt, viz. a few miles to the ſouthward of Douglas (or perhaps nearer to the borders of Lanerk and the ſhire of Air, about 10 or 12 miles to the eaſtward of Auchenleck), part of the tail ſeemed to break off, and to diſperſe in bright ſparks of fire; whilſt the head, into which the remainder of the tail was inſtantly collected, moved on in the ſame

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* Some of the moſt material are ſubjoined in notes to the former paper, ſince it was firſt preſented to the Society.

direction, till coming over Fort William, in the ſhire of Inverneſs, after a courſe of about 400 miles, it there ſuddenly diſappeared.

But, notwithſtanding the extinction of the meteor at this place, it ſeems ſtill to have proceeded northwards; ſince it was ſeen again, in a luminous ſtate, in a globular form, but without a tail, about the 58° of latitude, on the weſtern coaſt of the ſhire of Roſs, almoſt vertical to the obſerver; moving then to the ſouthward of the eaſt; that is, in a direction almoſt contrary to the firſt: and in this laſt courſe, of which we know not the end, it poſſibly might have gone a great way to the eaſtward.

During the firſt part of its progreſs, viz. from Cambridge to Fort William, it went obliquely downwards, in ſuch a manner, that, by computation, it muſt have been from about 90 to 100 miles high at the firſt of theſe places, and between 26 and 32 miles at the laſt. But at what height it was afterwards ſeen in the ſhire of Roſs, is not to be determined, ſince one obſervation only was tranſmitted to me from that country. As Dr. Mackenzie obſerved it nearly over his head, and yet of a ſmaller ſize than the full moon when ſome hours above the horizon, I ſhould ſuſpect, that, after its deſcent to Fort William, it had reaſcended at the time he ſaw it; becauſe he probably would have deſcribed it as a larger body, if then not higher than when it firſt diſappeared.

This dipping and riſing, in the courſe of a meteor, is not more extraordinary than its lateral deviation from a ſtreight line, as I have elſewhere ſhewn*. Such are the facts, tho', perhaps, it may be hard to account for them from the common principles of motion. What ſeemed moſt likely to be the cauſe of the vertical change of its direction, was its rapid deſcent towards the earth, till it came ſo low as that the reſiſtance of the air might act upon it; in which caſe, the lower part of the body meeting with denſer air than the upper, it would be ſo reflected from that medium as to aſcend; for tho', at the height of 20 or 30 miles, the air is extremely rarified, yet, in this inſtance, the immenſe velocity of the impingent body will make a leſs reſiſting medium produce a greater effect. The meteor, therefore, might be reflected by the air, in the ſame manner as a cannon ball by water, when it ſtrikes it in a very oblique direction.

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* See the note ſubjoined to Obſ. XXVII.

If this reaſoning can be admitted, we may account for the lateral variation of its path, in the manner following. Although it ſhould ſeem, that, during the firſt part of the courſe, the wind was at S. E. yet, when the meteor advanced towards the north of Scotland, it there probably met with a weſterly wind; from this circumſtance in Dr. Mackenzie's letter, *of the ſea being that night remarkably louder than at any other time during a whole month he had been at Flowerdale:* for that place lies on the weſtern ocean, in the ſhire of Roſs; and there, I imagine, the ſea could not produce that ſtormy noiſe, unleſs the wind had blown from ſome point between the weſt and the north. If therefore the current of the air obliquely oppoſed the motion of the meteor, that body would be gradually reflected into a new direction; from which, by another current, it might have been turned a ſecond or a third time, until it fell at laſt into that path deſcribed by the doctor. From this account it will follow, that the lower a meteor deſcends, the more irregular its courſe will be; as it will then meet with the moſt reſiſtance, both from the denſity and the currents of the air.

In regard to the velocity, it ſeems almoſt incredible; as we have ſufficient *data* for computing it at the rate of 30 miles in a ſecond. But if we allow, that it only moved through half the ſpace in that time, we ſhall find the progreſſion of this body to have been above 100 times ſwifter than the mean celerity of a cannon ball, and nearly equal to that of the earth in its orbit round the ſun.

As to its real ſize, we cannot pretend to determine that point with any preciſion; ſince its dazzling brightneſs would occaſion ſome deception, and the apparent magnitude has been ſo differently repreſented by the obſervers. If the meteor, when neareſt to Dublin, appeared to Mr. Garret equal to the full moon, then we ſhall find, that its true diameter was about two miles; and if the farmer at Ancram ſaw this body, whilſt it was vertical at Cambridge, of a ſize equal to the crown of his cap, or to about half that of the full moon, we cannot allow leſs than a mile for the real axis. Upon eſtimating from the obſervations made at St. Andrews and Dunfermline, the diameter was at leaſt half a mile, and perhaps much greater. However, as the imagination is ſo apt to enlarge ſuch objects, we ſhall put the ſize of the globe at the ſmalleſt, and reckon it only about a mile and a half round.

The body muſt ſurely have been of a conſiderable bulk to have yielded ſuch a light, as that, when in the zenith of Cambridge, the farmer at Ancram (at the diſtance of above 260 miles) ſhould, upon entering his threſhold, ſee the whole ſide of his houſe illuminated by it; and, to uſe his own expreſſion, *with a brightneſs as of ſun-ſhine.* And indeed the greatneſs of the light is every-where taken notice of, even at thoſe places where the atmoſphere was ſo thick as to hide the tail, nay, the whole meteor, as at Auchenleck, where it was nearly vertical.

As for the tail, it was a ſtream of light ſeveral miles in length; for this was no deception, like what we ſuppoſe the train of a ſhooting ſtar to be, but was either a real flame, or, what is more probable, it conſiſted partly of flame, but moſtly of ſmaller maſſes of fire (which the obſervers call *ſparks*, when falling out of the lucid tract), and of vapours or fuliginous particles, not heated red-hot, but illuminated by the parts actually burning. Perhaps theſe vapours were the chief part of the compoſition, and which will account for its light being ſo much fainter than that of the head; ſince in ſome places where the air was leſs clear, or the diſtance greater, we find the whole meteor deſcribed either as a round ball, or a ſpheroid (with the largeſt axis in the direction of its motion), but without a tail. In this laſt caſe, viz. that of the oval form, it is probable that, beſides the head, the beginning of the tail was alſo viſible, as conſiſting of flame, and therefore brighter than the reſt; and that both together appeared oblong to thoſe obſervers. But ſuch as were neareſt, and had a clear atmoſphere, ſaw the tail of a conſiderable length; that is, the flame, the ſparks and the illuminated vapour, in a train behind the head, as being lighter, and therefore meeting with more reſiſtance from the air; in the ſame manner as the flame, the ſparks, and ſmoak, of a torch are ſeen to follow it. All this is plain; but, in regard to that ſeparation of the third part of the tail from the reſt, a circumſtance clearly deſcribed by the farmer at Ancram, and ſeemingly confirmed by other obſervations, there may be ſome difficulty. Perhaps at this period, upon a greater exploſion in the ball, moſt of the combuſtible matter was thrown out at once, which falling behind, occaſioned that appearance of the breaking off a part of the tail, whilſt, for want of fuel, the remainder vaniſhed, or, as the obſerver expreſſes it, *was collected into the head*. This account is rendered more probable, by what is ſaid of the emiſſion of a greater light about this time, and by the loud report heard by the farmer five minutes after, and which, upon computing the diſtance, ought to have reached him much about that time, had it been occaſioned by this extraordinary burſting and diſperſion of the inflammable matter.

The hiſſing noiſe, taken notice of by ſome while the meteor paſſed them, was a deception of that kind, which frequently connects ſound with motion; and is the caſe of thoſe who fancy they hear ſomething, when they ſee the ſhootings of the *aurora borealis*; I ſay a deception, becauſe if the meteor, during its courſe, really made any noiſe, ſo great was the diſtance of that body, and ſo ſhort its continuance, that this ſound could not have been heard till ſome minutes after the return of darkneſs. But the final report, ſo frequently mentioned, not only heard by thoſe who ſaw the light, but by others who knew nothing of what had happened, was a real ſound, and immenſely greater than any we are acquainted with. For, at the diſtance of 70 miles and upwards, it was compared to loud thunder, the report of heavy artillery, the fall of the gabel-end of the houſe the perſon was in, and to a muſket fired off in the garret. If this noiſe was produced when the body threw out thoſe maſſes of burning matter (by the obſervers called ſparks of fire, the burſting of the tail, and delineated in *Fig.* 5. as balls of a ſmaller ſize in the train itſelf), we ſhall find, that at this time the meteor, by being more than 41 miles high, was in a region where the air is three thouſand times rarer than on the ſurface of the earth; that is, about ſix times rarer than in a common exhauſted receiver, where ſonorous bodies are not heard, and even where gunpowder and the *pulvis fulminans* take fire, and are exploded, but without noiſe. Hence I would infer, that the ſeparation of the elaſtic matter muſt have been performed with a velocity exceeding all imagination; as the intenſity of ſound ſo much depends on the reſiſtance of the air, and as this elaſtic matter could fly off with ſo much celerity, as to find ſo great an oppoſition from ſo thin a medium *.

I ſhould alſo conclude from the great report, that the ſubſtance of the meteor was of a firmer texture than what could ariſe from mere exhalations, whether formed into a ſphere, and then burning; or diſpoſed into a kind of train, and conſumed by a running fire: for ſounds, as far as we know, are either produced by the quick and violent percuſſions of hard bodies upon the air; or by the ſudden expanſion of an elaſtic fluid, after being condenſed within ſome ſolid ſubſtance. The noiſe occaſioned by the motion of electrical matter is, perhaps, the only exception; but we have no reaſon to imagine, that this was at all concerned in the preſent caſe. There ſeems to be the more ground for believing this body was ſolid, at leaſt that its ſurface was ſo, from finding, that, after the violent exploſion, it ſtill retained its form; a circumſtance that could hardly take place, if the meteor had conſiſted of nothing but vapours. We may therefore preſume, that the burning matter found vent through a hard cruſt by certain apertures, which either might have been there inviſible, or unobſerved. All I can ſay in ſupport of this conjecture is, that, by the Memoires of the Academy of Bologna, we find a meteor appeared in Italy in the year 1719, lower in the air than that we have now been treating of, and in which, it is pretended, four ſeveral chaſms were diſtinguiſhed, each emitting ſmoke *. To theſe arguments for the ſolidity of this body, we may add its extreme velocity, and the intenſity of the light; which are likewiſe circumſtances more conformable to a heavy and ſolid ſubſtance, than to one formed of exhalations only.

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* *M. Saluce* has lately ſhewn, by ſome curious experiments, that ſuch ſubſtances as gunpowder and the *pulvis fulminans*, have a detonation in proportion to the rapidity with which the internal air is ſeparated, and to the reſiſtance of the external air. See *Miſcell. Taurinens. Tom.* I.

Upon the whole, I believe it will appear, that theſe relations are not favourable to the prevailing

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* *Apparebant in eo hiatus ſeu voragines quatuor fumum exhalantes. Inſtit.* & *Acad. Bonon. Tom.* I. *p.* 285.

*hypotheſis* about the formation of ſuch bodies, which makes them to conſiſt of certain ſulphureous vapours ariſing from the earth: for, beſides what has been urged above, Dr. Halley has ſhewn, " That, at the " height of 41 miles, the air is ſo rarified as to take " up 3000 times the ſpace it occupies on the ſurface " of the earth; and that, at 53 miles high, it would " be expanded above 30000 times: but thinks it is " probable, that the utmoſt power of its ſpring cannot " exert itſelf to ſo great an extenſion; and that no " part of the atmoſphere reaches above 45 miles *." This being the caſe, how can we ſuppoſe any ſuch vapours to riſe to the height of 90 or 100 miles, where the air muſt be ſo many millions of times rarer than what we breathe? Again, we find that all vapours, in their aſcent, mutually repel one other; ſo little do they ſeem diſpoſed to run together into globes of ſuch a ſize. But Dr. Halley obſerves (in treating of the great meteor of March 1719), " That " tho' the aqueous, and moſt of the other vapours, " are ſoon condenſed by cold; and wanting a certain " degree of ſpecific gravity in the air to buoy them " up, aſcend but to a ſmall height;" yet he adds, in favour of the opinion of theſe bodies being formed of exhalations, " That the inflammable ſulphureous " vapours, by an innate levity, have a ſort of *vis* " *centrifuga*, and not only have no need of the air " to ſupport them, but, being agitated by heat, will " aſcend in *vacuo Boileano*." From hence he infers, " That the ſulphureous vapours, diſengaged from all " other particles, may riſe far above the reputed

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* Phil. Tranſ. N° 181. p. 104. Abridg. Vol. II. ch. 1. § 9.

“ limits of the atmoſphere; and contracting them-
“ ſelves into a narrower compaſs, by that principle
“ of nature that congregates the *homogenea*, may lie
“ like a train of gunpowder in the æther, till catch-
“ ing fire by ſome internal ferment, the flame may
“ be communicated to its continued parts, and ſo
“ run on like a train fired,” &c[*]. But this *hypotheſis* of that excellent naturaliſt ſeems liable to the following difficulties. 1. What are the experiments which ſhew, that inflammable vapours have any ſort of a *vis centrifuga*; or will riſe either in an abſolute vacuum, or in a medium where the meteors are often found, and where, according to the doctor, the air muſt be five hundred times rarer than in a common exhauſted receiver[†]? 2. Altho' ſulphureous vapours may aſcend from the earth, upon being agitated by heat, will not that volatility ſoon ceaſe, by the coldneſs of the air, long before they can arrive at the upper regions? 3. Does not all matter, capable of taking flame, ſuppoſe a proportion of an acid ſalt, adherent to the phlogiſtic principle, and conſequently ſome gravitation? 4. And will not the weight be increaſed by the large quantity of condenſed air, or ſome other elaſtic fluid combined with the inflammable vapours, which is the cauſe of the exploſion and report? 5. Are we not led to this notion about the innate levity and *vis centrifuga* of igneous matter, from finding, that heat has a greater tendency upwards

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[*] Phil. Tranſ. N° 360. p. 978. Abr. Vol. IV. Par. II. Ch. 1. § 28.

[†] His expreſſion is, *above three hundred thouſand times rarer than what we breathe.*

than downwards? but is not this owing to that portion of the air, which, receiving the heat, and being thereby dilated, becomes ſpecifically lighter than the reſt, and therefore riſes in the colder and more condenſed atmoſphere? 6. Suppoſe attraction to take place, ſhould not thoſe vapours, by that law, aſſume a globular form, and not, like a train, contract in breadth, and extend in length? 7. What is to ſet this train on fire; ſince a ferment, according to the chemiſts, implies a mixture of heterogeneous parts, contrary to the doctor's *hypotheſis*? 8. How comes this train to be drawn out in ſo ſtreight a line, and of ſo equal a breadth, inſomuch that, in the path of the late meteor, for about 400 miles, there was no ſenſible deviation, nor any change in the magnitude of the luminous appearance, but what might be accounted for from its greater or leſs diſtance from the obſerver, or its being ſeen through a clearer or an obſcurer atmoſphere?

Some have been of opinion, that theſe fiery meteors are only a kind of lightning, at greater heights than common; forming their notion upon the velocity of thoſe balls of fire, and upon the ſound accompanying them, ſo much reſembling that of thunder. But this *hypotheſis* having gained no credit, I need not employ time in refuting it; and the leſs now, as the nature of lightning is ſo much better underſtood than when this theory was firſt publiſhed. I ſhall only obſerve, that before the matter of lightning was diſcovered to be of the electrical kind, it was natural to ſuppoſe it to be formed of the ſulphureous vapours ariſing from the earth; and if the earth was found proper for producing ſuch exhalations, of

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courſe it was judged capable of furniſhing materials for all the lucid *phænomena* in the æthereal regions. Thus, not an hundred years ago, the comets themſelves were accounted for on no better principle; and therefore we are the leſs to wonder if theſe meteors have been hitherto almoſt conſtantly referred, even by the beſt naturaliſts, to the ſame origin.

Of all the *hypotheſes* that have come to my knowlege on this ſubject, a hint of Dr. Halley's (in a paper preſented to the Society ſeveral years before the above-mentioned), ſeems beſt to agree with the late meteor; viz. that ſuch bodies may be formed independent of any vapours from the earth *. But, with regard to the reſt of his conjecture, that the one he deſcribed, "might be a collection of matter formed in "the æther by ſome fortuitous concourſe of atoms; "and that the earth had met with it newly formed, "and before it had conceived any great *impetus* of "deſcent towards the ſun," I ſay, with regard to theſe circumſtances, they are not at all ſupported by the preſent caſe: for, if we conſider the immenſe velocity with which the late meteor moved northwards (and in judging of which we could not be deceived by either the diurnal or annual motion of the earth), we muſt be convinced that the earth did not meet with it before it had conceived a conſiderable *impetus* of deſcent, either towards the ſun, or ſome other attracting power. And altho' there was likewiſe a motion of this body towards the earth, as appeared by the dipping of its path, yet it did not come quite down, as might have been expected, had gravitation to the earth been the only principle concerned; but it deſcended no lower than to a certain depth in the atmoſphere, after which it ſeems to have riſen again, and made a conſiderable progreſs in the higher regions; contrary to Dr. Halley's opinion about ſuch meteors, which, he believed, actually came to the ground *. And here I will venture to affirm, that, after peruſing all the accounts I could find of theſe *phænomena*, I have met with no well-vouched inſtance of ſuch an event: nor is it to be imagined but that, conſidering the frequency of ſuch appearances, if theſe meteors had really fallen, there muſt have been long ago ſo ſtrong evidence of the fact, as to leave no room to doubt of it at preſent. Their deſcent, under the horizon, is ſufficient to make the common obſervers believe they ſee them come to the ground, whilſt an exploſion, high up in the air, coming late to their ears, paſſes for the craſhing noiſe of the fall. Not that I call in queſtion the poſſibility of their touching the earth; which they are likely to do as often as they move perpendicularly towards it, and not in that oblique direction ſo often mentioned, and by which means, it ſhould ſeem, they are conſtantly reflected by our atmoſphere. All that I would conclude is, that hitherto we have had no certain proof of their fall; and it is to be hoped, that their motions, like thoſe of the comets, have been ſo regulated at firſt by a governing Power, that we have nothing to apprehend from their aberration. Unleſs we ſhould imagine, that the perpendicular deſcent and burſting of one of theſe bodies has given riſe to the ſtory of Phaëton; ſince no other event will, perhaps, ſo well account for not only the foundation of that fable, but for a prevailing opinion among the ancients, that, beſides a large tract of country, even the heavens themſelves, in appearance, had once ſuffered by a conflagration.

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* Phil. Tranſ. N° 341. p. 159. Abr. Vol. IV. Par. II. Ch. 1. § 25.

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* Vide loc. cit.

If it is then probable, that theſe balls of fire come from regions far beyond the reach of our vapours; if they approach often ſo near to the earth, and ſo ſeldom or never touch it; if they are moved with ſo much celerity, as in that reſpect to have the character of celeſtial bodies; if they are ſeen flying in all directions, and conſequently have a motion of their own, independent of that of our globe; if they part with ſuch quantities of an elaſtic fluid, a phlogiſtic matter, and probably an acid, ſurely we are not to conſider them as indifferent to us, much leſs as fortuitous maſſes, or trains of terreſtrial exhalations in the æthereal regions; but rather as bodies of a nobler origin, poſſibly revolving about ſome center, formed and regulated by the Creator for wiſe and beneficent purpoſes, even with regard to our atmoſphere; which, during their combuſtion, they may ſupply with ſome ſubtile and ſalutary matter, or remove from it ſuch parts as begin to be ſuperfluous, or noxious to the inhabitants of the earth.

Since theſe ſheets were printed off, Dr. Pringle received another letter from Sir Robert Pringle, acquainting him, he had not found that part of his intelligence hold good, of the ſhip-maſter's ſeeing the meteor (of the 26th of November 1758) in the Baltick; but, upon further inquiry, had learnt, that though this perſon had obſerved an appearance of the ſame kind in thoſe ſeas, it was not on the ſame day.

Dr. Pringle thinks it likewiſe proper to inform the public, that, ſince his paper was printed, he has received two further accounts of the meteor, one from Mr. Pringle, ſheriff-depute of the ſhire of Roxburgh, the other from Mr. Garret, of Iſland-Bridge, near Dublin. Mr. Pringle ſays, “ that having, ſince his laſt letter, drawn a more “ accurate meridian, at the farmer's houſe at Ancram, he now finds, “ that the ſhepherd's houſe (mentioned p. 236) bears nearly S. E. by “ S. from the farmer's dwelling-houſe; that the hill with the trees, “ over which the meteor ſeemed to break (laid down in *Fig.* IV. as at “ 92° 30′ W. of the meridian), really bore W. by N. from the “ obſerver; and that the bearing of the luminous body, at the point “ of its extinction, was nearly W. N. W. and not due N. W. as the “ farmer at firſt imagined, who, upon this laſt ſurvey, was convinced “ of his miſtake.” Upon this communication, Dr. Pringle drew, on two different maps, a W. N. W. line from Ancram to the path of the meteor, and found, that in Elphinſton's map of Scotland, the interſection was a few miles to the eaſtward of Glaſgow, but in Kitchin's map a little to the weſtward of it. In conſequence of theſe laſt obſervations, the Doctor has fixed the point of extinction to the zenith of that city. But as Glaſgow lies about 76 miles to the ſouthward of Fort William, over which the meteor, in the preceding paper, was ſuppoſed to diſappear, the firſt courſe of that body is reduced to about 324 miles in thirteen ſeconds of time, and its velocity therefore to about 25 miles in one ſecond. Mr. Pringle has likewiſe acquainted the Doctor, “ that the farmer, on ſeeing the engraving of the 4th “ figure (of which Mr. Pringle had received a copy), had found fault “ with the ſize of the head of the meteor, as being too large in pro- “ portion to the length of the whole; ſince, to his imagination, the “ diameter of the head did not exceed 8 inches, and that the tail ſeemed “ to be about 3 or 4 yards long.”

Mr. Garret acquaints Dr. Pringle, “ that, ſince his firſt letter to the “ Doctor, Emanuel Miller and he, having communicated their obſer- “ vations to Mr. William Gibſon, mathematician, at Dublin, that “ gentleman had come to Iſland-Bridge, and having made a ſurvey “ with his inſtruments, found, that the greateſt altitude of the meteor “ was no more than 12 degrees.”

## ERRATA.

*P.* 240. *lin. penult.* for P Q R U, *the path of the tail broke off over the trees,* read Q R S U *the path.* E F *the tail broke off.*

In the plate, E F *the breaking of the tail,* ſhould not have been repreſented as directly over the trees, but a little more to the ſouthward, ſo as to bring the ball W (viz. the meteor at its extinction) perpendicularly over the ſaid trees.